

THE FIRST FINDING OF THE MALE OF
THAUMATOCYPRIS ECHINATA MÜLLER, 1906
(CRUSTACEA: OSTRACODA)

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Abstract.—Two adult males and two juveniles of *Thaumatocypris echinata* Müller, 1906 were found in the near-bottom layer off the west coast of Madagascar at the depth of 180–1220 m. The first description of male morphology is given. The sexual dimorphism manifests itself in the structure of mandibular endopodite instead of endopodite of second antenna as it was known for other halocypridids previously. The contents of the gut suggest that the species is either a carnivore or scavenger.

The myodocopid ostracod genus *Thaumatocypris* with only species *T. echinata* was established by Müller (1906) on six females derived from a depth of 1100 m near Indonesia. Since then, only one female of the type species was found nearly in the same region at the depth of about 2000 m (Poulsen 1969).

Two other living genera of the family Thaumatoocyprididae, all benthic—*Thaumatoconcha* (eight species) and *Danielopolina* (six species) were thoroughly investigated by Kornicker & Iliffe (1989a, 1989b) and by Kornicker & Sohn (1976). The latter authors also used the opportunity to reinvestigate the specimen of *Thaumatocypris echinata* described by Poulsen (1969).

Plankton investigation in the near-bottom layer of the Indian Ocean off the west coast of Madagascar (17th trip of R/V *Vityaz*) revealed a few specimens of the genus *Thaumatocypris*. The Madagascar specimens (two males and two juveniles) were preliminarily studied by Dr. Louis S. Kornicker (National Museum of Natural History, Smithsonian Institution, Washington, D.C.), who returned them to me with the kind suggestion to prepare the first male description. Two males have been deposited to the U.S. National Museum of Natural History and given USNM numbers.

Materials and Methods

Ostracods were collected in the 17th cruise of R/V *Vityaz* by the towing underwater apparatus “SOUND” equipped with opening/closing plankton sampler (Biryukov et al. 1990). Observations are briefly summarized below.

Station (St.) 2649; 3 Dec 1988; 0206–0306 h; 22°25'S, 43°00'E; 970–950 m; 30 m above bottom. 1 male USNM 194110 (1.16 mm), 1 juvenile specimen (0.65 mm).

St. 2655; 3 Dec 1988; 1917–2017 h; 22°22'S, 42°54'E; 1212–1220 m; 1.5 m above bottom. 1 juvenile specimen (0.72 mm).

St. 2661; 4 Dec 1988; 1200–1230 h; 22°13'S, 43°07'E, 260–180 m; 30 m above bottom. 1 male USNM 194116 (1.20 mm).

The specimens were preserved with formaldehyde and after about two-years storage transferred into alcohol. The males were dissected in water diluted glycerol. Appendages were placed on slides moistened with Faurès liquid diluted 3–4 times with water. After hardening of the fluid with the appendages mounted in a necessary order and position, a drop of molten glycerol-gelatin was deposited on a membrane formed on the fluid, and a cover glass added (Rudjakov 1968). Separated valves were mount-

ed on the shallow-well slides with glycerol-gelatin.

Results

The following description of the adult male was mostly prepared using the specimen from St. 2661, supplemented with the features of the specimen from St. 2649 when necessary.

Thaumatocypris echinata Müller, 1906

Figs. 1a–d, 2a–c, 3a–d, 4a–f, 5a, b

Thaumatocypris echinata Müller, 1906:42, pl. 6, figs. 1–18; 1912:54 [listed].—Poulsen, 1969:7, fig. 1.—Kornicker & Sohn, 1976:34, figs. 14c, d, 15.

Description.—Shell (Fig. 1a). Surface smooth, without discernible anterior ridges and serration along posterior ridge. Each valve with short upper and long lower tube-like anteroventral horns, appearing broken. The shell can firmly stand on its four horns, anterior side down, with furcal lamellae just above ventral pair of horns and with antennal and mandibular bristles protruding between dorsal and ventral pairs of horns. Postero-dorsal ridge of right valve with short rounded tubercle (hardly discernible on the male from St. 2661). Antero-ventral margin of each valve with hairs distally bifurcate or split into several branches. Indistinct adductor muscle attachment scar (Fig. 1b) does not form radial pattern (patterns of left and right valves seem to differ significantly). Scar consists of about 9–18 muscle segments. Length 1.16–1.20 mm, height 0.90–1.05 mm (without horns).

First antenna (Fig. 1d): 8-jointed, third and fourth joints being not clearly separated. First joint without spines and hairs, with 1 bare dorsal bristle about as long as ventral side of second through fourth joints combined and 1 proximally spinous lateral bristle, as long as 6 distal joints together, directed dorsally. Second joint with hairs dorso-laterally and proximo-ventrally, with

1 ventral bristle reaching to eighth joint or exceeding it and 1 dorsal bristle reaching to fifth joint, both bristles without discernible spines. Third joint with long hairs on dorsal and ventral sides, its dorsal margin somewhat shorter than dorsal margin of fourth joint. Fourth joint with ventral group of hairs and 2 spinous disto-ventral bristles, short bristle reaching or exceeding eighth joint and long bristle as long as total length of dorsal margin of 7 distal joints. Fifth joint with ventral group of hairs and 3 bristles on disto-ventral corner, 1 bristle (not the longest) medially with short hairs in proximal part, long bristle about 2.2–2.8 times total length of 7 distal joints, others about 2 times their total length. Sixth joint with dorsal group of hairs, without bristles. Seventh joint with 1 short dorsal spinous bristle as long as combined length of 3–4 distal joints and with 2 long disto-ventral bristles, the longest of them being about 3.1–3.5 times total length of 7 distal joints. Eighth joint with two bristles, dorsal bristle covered with stout small spines along dorsal margin being about 3.9–4.3 times total length of 7 distal joints.

Second antenna: Protopodite with cluster of hairs in proximo-ventral area, without bristles. Exopodite 9-jointed, first joint divided into long proximal and short distal parts. Joints 2–8 each with 1 long bristle with natatory hairs. Ninth joint with 2 bristles, short and long, both devoid of natatory hairs. Endopodite 2-jointed (Fig. 1c), but very short distal part of second joint may be interpreted presumably as third joint. First joint with long hairs, 1 ventral and 2 dorsal bristles, ventral bristle with marginal spines. Second joint with 2 transverse rows of hairs, 1 lateral bristle bearing spines along ventral margin and 2 pre-terminal bristles. Terminal part of second joint (or third joint) with 2 bristles, ventral one being the longest.

Mandible (Fig. 2a–c): Coxale endite seems to have the same character set as *Thaumatococoncha radiata* Kornicker et Sohn, 1976: proximal set of teeth with four broad teeth, some of them bifurcate. Distal set with

two large flat teeth bearing several cusps and distally flattened spinous bristle. Basale with knife-like process and 11 bristles, which can be subdivided into 4 groups: 3 posterior bristles, 1 anterior bristle, 5 lateral bristles and 2 medial bristles, the longest of the latter with long hairs. First endopodite joint with 1 dorsal bristle, second joint with 4 bristles on ventral margin and 2 bristles on dorsal margin. Third endopodite joint with 7 bristles, the longest bristle with ca. 10–12 long spines directed distally in the middle part of its posterior side, with ca. 80–90 short spines along posterior side and sparse short spines along anterior side more distally. Shorter of the 2 stouter bristles seems wavy bent with long spine-like processes (ca. 10 along each side) in the middle and with very short fine spines more distally. Distal half of the longest bristle of the terminal joint with fine short spines.

Maxilla (Fig. 3a–d): First endite with 1 proximal and 7 distal bristles, second endite with 7–9 bristles, third endite with 6 bristles distal of which being not partitioned off the endite body. Basale with 1 long dorsal (covered with long hairs along ventral side) and 1 shorter lateral bristles. There is 1 lateral bristle between basale and first endopodite joint. First endopodite joint with long hairs bearing 5 dorsal bristles and 2–3 disto-lateral bristles. Second endopodite joint with 5–6 bristles, of which 1 distal bristle being claw-like and not clearly partitioned off the joint.

Fifth limb (Fig. 4a, b): Epipodial appendage with 14 bristles arranged in 3 groups of 5 (dorsal), 5 and 4 (ventral). Protopodite and endopodite with total of 19 bristles in 3 indistinct groups each with 6 (proximal), 7 and 6 (distal) bristles. First exopodite joint hirsute with 1 long disto-dorsal bristle and 9 ventral bristles. Second joint with hairs and 2 midventral bristles. Third joint with 3 terminal bristles, length of the shortest of them (ventral) being about 36% of others.

Sixth limb (Fig. 4c): Epipodial appendage with 15 bristles arranged in groups of 6 (dor-

sal), 4 and 5 (ventral) bristles. Hirsute pre-coxale, coxale and basale each with 2 ventral bristles. Disto-dorsal process of basale (endopodite?) with 1 long bristle and small spine. First exopodite joint with 2 disto-ventral bristles, second with 1 dorsal and 2 midventral bristles. Third joint with 3 terminal bristles, length of the shortest of them (ventral) being about 39% of others.

Seventh limb (Fig. 4d): With 2 finely spinous bristles of nearly equal length.

Copulatory organ (Fig. 4e, f) consists of elongate anterior part and tapered posterior part with 3 hardly discernible transparent hair-like appendices. Anterior part with a single long tooth-like process not reaching distal part of the organ.

Lip morphology (Fig. 5a) is consistent with family diagnosis given by Kornicker & Sohn (1976).

Rod-shaped organ not discernible.

Furca (Fig. 5b): Each lamella with 2 long anterior claws separated from lamella, followed by 6 short spinous claws joined to lamella and by 1 bare triangular process oriented like preceding claws (the latter is absent on right lamella of the specimen from St. 2649).

Posterior of body with hook-like process proximal to furcal lamellae oriented posteriorly.

Discussion

A comparison of the described specimens of *T. echinata* with descriptions and drawings by Müller (1906) and Poulsen (1969) and with supplemental description and summary of characters given by Kornicker & Sohn (1976) reveals a set of differences (Table 1). Only one of them may be attributed to sexual dimorphism for certain: the number of ventral bristles of fourth joint of first antenna (as in the other Thaumatoctypridid genera). Some differences may be sexually dimorphic: presence of the lateral bristle of first antenna's first joint, the bristle number of first antenna's seventh joint, the

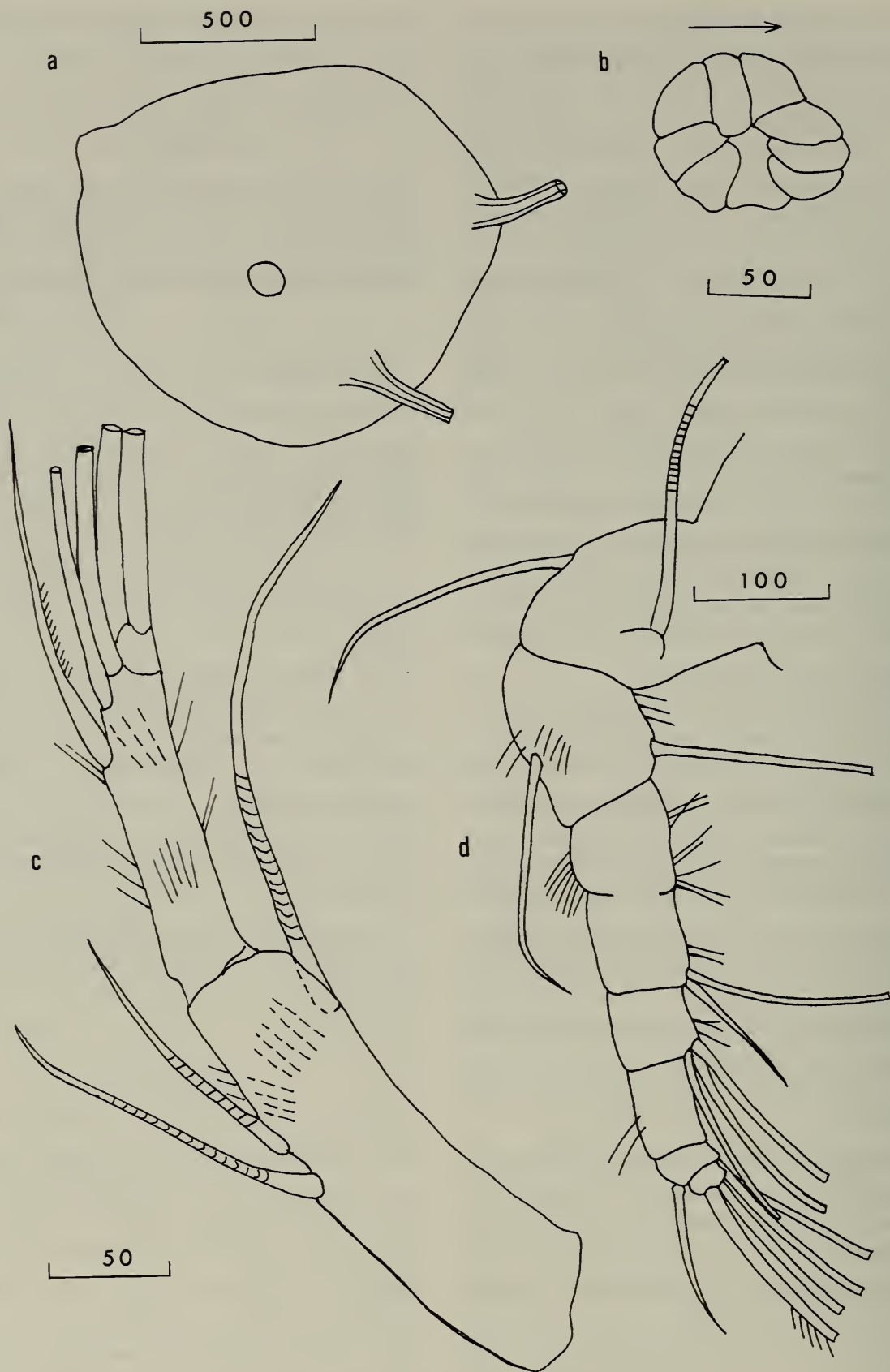


Fig. 1. *Thaumatoocypris echinata* Müller, 1906, adult male: a, Outside view of right valve of the specimen from St. 2649; b, Adductor muscle-scar of the right valve of the specimen from St. 2649; c, Endopodite of left 2nd antenna of the specimen from St. 2661, medial view; d, Left 1st antenna of the specimen from St. 2661, lateral view. (Scale in micrometers.)



Fig. 2. *Thaumatoocypris echinata* Müller, 1906, adult male: a, 3rd endopodite joint of right mandible of the specimen from St. 2649, lateral view; b, Basale of right mandible of the specimen from St. 2661, lateral view; c, Endopodite of right mandible of the specimen from St. 2661, 3rd joint missing, medial view. (Scale in micrometers.)

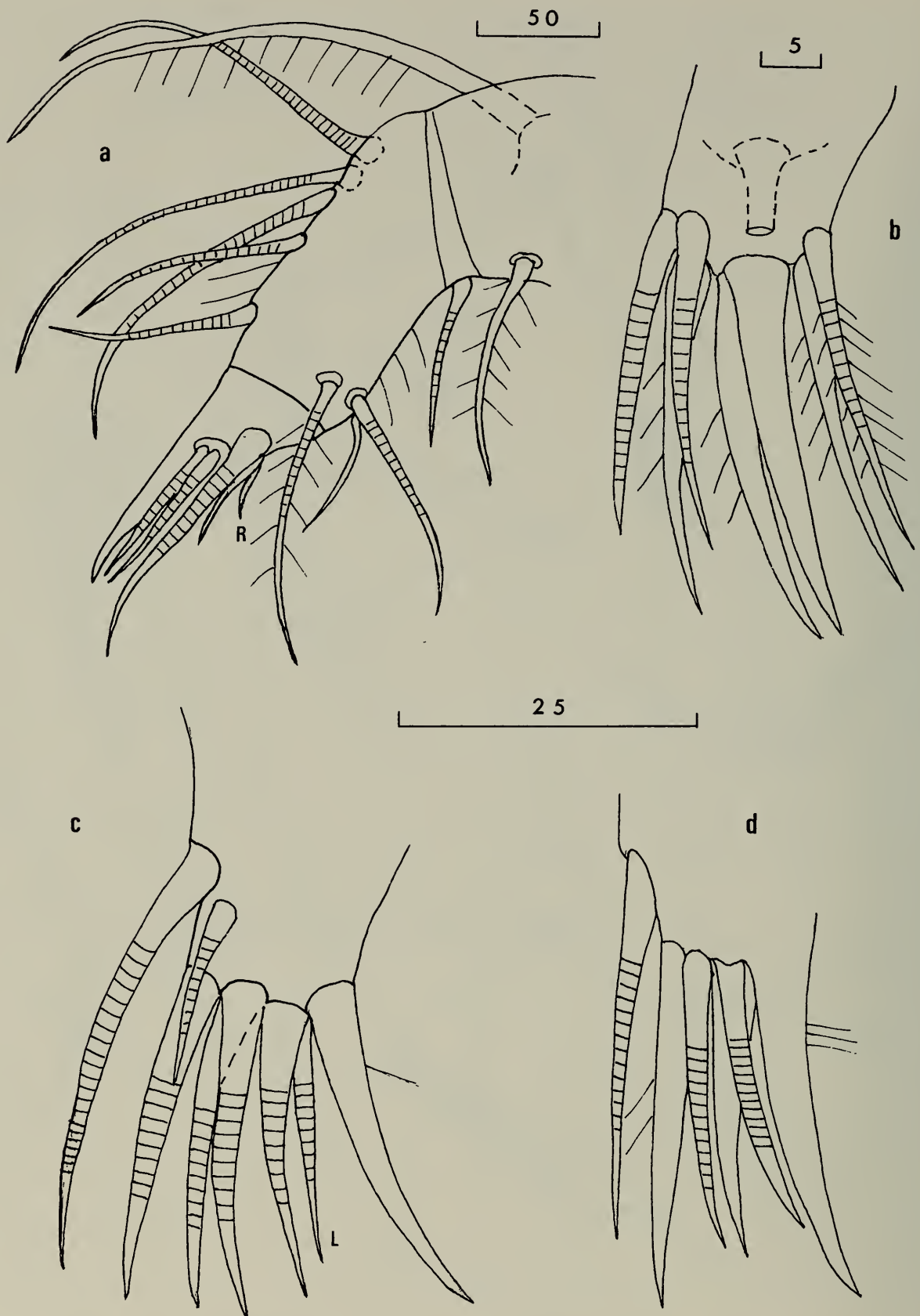


Fig. 3. *Thaumatocypris echinata* Müller, 1906, adult male, St. 2661: a, Basale and endopodite of left maxilla, lateral view (R—bristle found on right limb only); b, 1st endite of right maxilla, medial view; c, 2nd endite of right maxilla, medial view (L—bristle found on left limb only); d, 3rd endite of left maxilla, lateral view. (Scale in micrometers.)

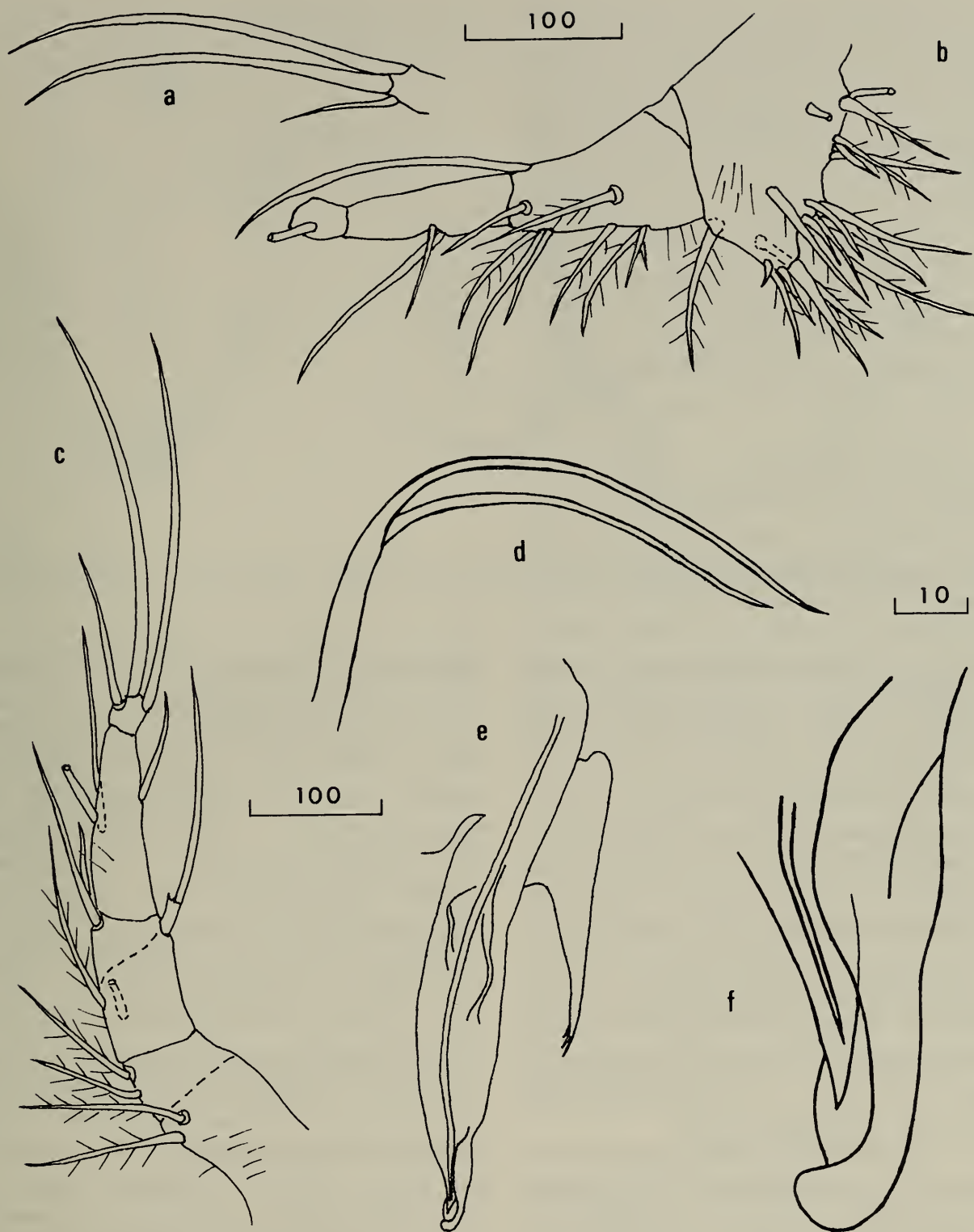


Fig. 4. *Thaumatoocypris echinata* Müller, 1906, adult male: a, Distal joint of 5th limb of the specimen from St. 2649; b, 5th limb of the specimen from St. 2661, distal bristles missing; c, 6th limb of the specimen from St. 2661 (dotted lines denote folds which can be erroneously interpreted as sutures between joints); d, 7th limb of the specimen from St. 2661; e, Copulatory organ of the specimen from St. 2661; f, Tip of copulatory organ of the specimen from St. 2661. (Scale in micrometers.)

armament of male mandibular endopodite terminal bristles (on two longest bristles the male has spines in place of hairs drawn for females by Müller and Poulsen) though these

suggestions are not supported by the sexual dimorphism in other genera of Thaumatoocypridids (Kornicker & Sohn 1976, Kornicker & Iliffe 1989). Some differences may

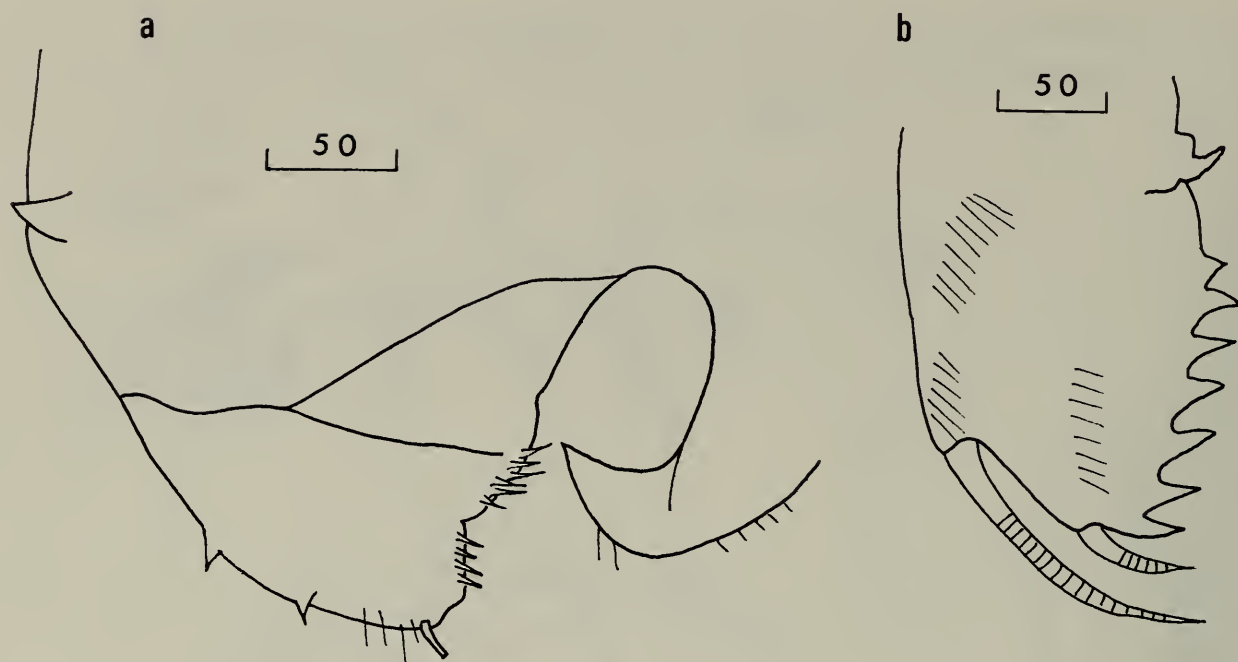


Fig. 5. *Thaumatoocypris echinata* Müller, 1906, adult male, St. 2661: a, Upper lip; b, Furca. (Scale in micrometers.)

prove to be a result of individual damage or variability (total number of bristles on mandible basale, of second joint of mandible endopodite or of first joint of fifth limb exopodite). Some bristle groups are difficult to count: epipodite bristles, bristles of maxillae coxale and of fifth limb. In many other instances there is much more similarity of the male with the female described by Poulsen and reinvestigated by Kornicker & Sohn than with Müller's non-adult female, though judging by Müller's drawing and by his specimen length (1.55 mm) it could not be younger than the A-1 developmental stage of Kornicker & Sohn (1976).

As it follows from the comparison above there are no morphological differences of *Thaumatoocypris* specimens investigated so far which could be treated as important on the species level. The length of the males found is smaller than one could predict on the basis of Müller's and Poulsen's female measurements (1.55 and 1.4 respectively) and male: female length ratio (1.06) determined by Kornicker & Sohn for *Thaumatoconcha radiata*. But the ratio may be quite different for *Thaumatoocypris* and geographical variability also may prove to be quite

significant. The latter may be the situation for the taxonomical importance of the posterodorsal process of the right valve in the males studied. Dr. Louis S. Kornicker pointed out in his letter reviewing the manuscript that "... there does exist some difference in the endopodite of the male and female 2nd antenna in that Poulsen and Müller show it to be truncate. . . ." This observation is true but the difference in question may be attributed to sexual dimorphism. These considerations form the basis for referring the males described to *Thaumatoocypris echinata*, but the final species identification will become possible after finding and investigation of *Thaumatoocypris* females from the Madagascar area.

The diagnosis of the genus *Thaumatoocypris* given by Kornicker & Sohn (1976:34) should be changed in several respects to include adult male and an emended diagnosis follows:

Each valve with upper and lower long anteroventral protuberances. First antenna: first joint with 0-1 lateral bristles; seventh joint with 2-3 bristles, 1-2 ventral, 1 dorsal; eighth joint with 2 bristles. Second antenna: first endopodial joint with 3 bristles, 1 ven-

Table 1.—Main morphological differences of *Thaumatoocypris* specimens known so far (number of bristles if other not indicated).

| Character | Female | | Male |
|--|-----------------|----------------|------|
| | Poulsen 1969 | Müller 1906 | |
| First antenna | | | |
| 1st joint: lateral | 0 | 0 | 1 |
| 4th joint: ventral | 1 | 1 | 2 |
| 6th joint | 1 | 0 | 0 |
| 7th joint: ventral | 1 | 1 | 2 |
| Mandible | | | |
| Basale | 13 | 12? | 11 |
| Endopodite | | | |
| 2nd joint: ventral | 4 | 3 | 4 |
| 2nd joint: dorsal | 2 | 3 | 2 |
| 3rd joint | 7 | 6 | 7 |
| Maxilla | | | |
| Basale: dorsal | 0 | 1? | 1 |
| Basale: ventral | 1 | 2? | 1 |
| Endopodite | | | |
| 1st joint: anterior | 4 | 5 | 5 |
| 1st joint: posterior | 2 | 2 | 2–3 |
| Fifth limb | | | |
| Epipodite | 13 | nd | 14 |
| Protopodite + endopodite | 17 | nd | 19 |
| Exopodite | | | |
| 1st joint: ventral | 8 | nd | 9 |
| Sixth limb | | | |
| Epipodite | ca. 12 | nd | 15 |
| Furca | | | |
| (no. of short claw- like processes) | 7 | 7 | 6–7 |

tral, 2 dorsal; terminal endopodial joint of male without hook-like process. Mandible: one of male endopodite terminal bristles wavy bent and with long spine-like processes in the middle. Maxilla: second endopodite joint with 6 bristles. Fifth limb: second exopodial joint without terminal bristle on ventral margin; third exopodial joint with 3 bristles. Sixth limb: process on dorsal corner of first exopodial joint with 1 bristle and 1 minute spine; third exopodite joint with 3 bristles. Rod-shaped organ is minute cone-shaped or not discernible.

The most striking peculiarity of the species is the absence of the sexual dimorphism in the endopodite structure of the second

antenna: there is no hook-like process typical for other halocypridinid males. Instead, the sexual dimorphism manifests itself in the mandibular endopodite terminal bristle morphology, not known in the other genera of the Halocyprida order. In other respects *Thaumatoocypris* males do not differ from other Thaumatoocyprididae genera. For example, the copulatory organ of *T. echinata* differs from those described by Kornicker & Sohn (1976:38, fig. 18) for *Thaumatoconcha*, but the extent of the difference is within the range of variability within the latter genus.

The contents of the gut (crustacean-like claws) suggest that the species is either a carnivore or scavenger. The species has not been found in the vertical plankton catches in the localities where the “SOUND” apparatus tows were made. Therefore the species may be attributed presumably to the near-bottom fauna as it was described by Heinrich & Rudjakov (1991).

Acknowledgments

I thank Dr. Louis S. Kornicker and anonymous reviewers who offered valuable suggestions for improvement of the manuscript. Thanks to the crew and scientific team of the R/V *Vityaz* for help collecting. Special thanks to A. K. Heinrich, my wife and son who helped with the figures. Manuscript preparation was supported by the Soros Foundation.

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